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ABSTRACT

This science unit is designed for limited- and non-English speaking students in a Chinese bilingual education program. The unit covers rock material, classification, characteristics of types of rocks, and rock cycles. It is written in Chinese and simple English. At the end of the unit there is a list of main terms in both English and Chinese, and student activities. The booklet may be used along with "Matter--An Earth Science, Unit 4." (AMH)

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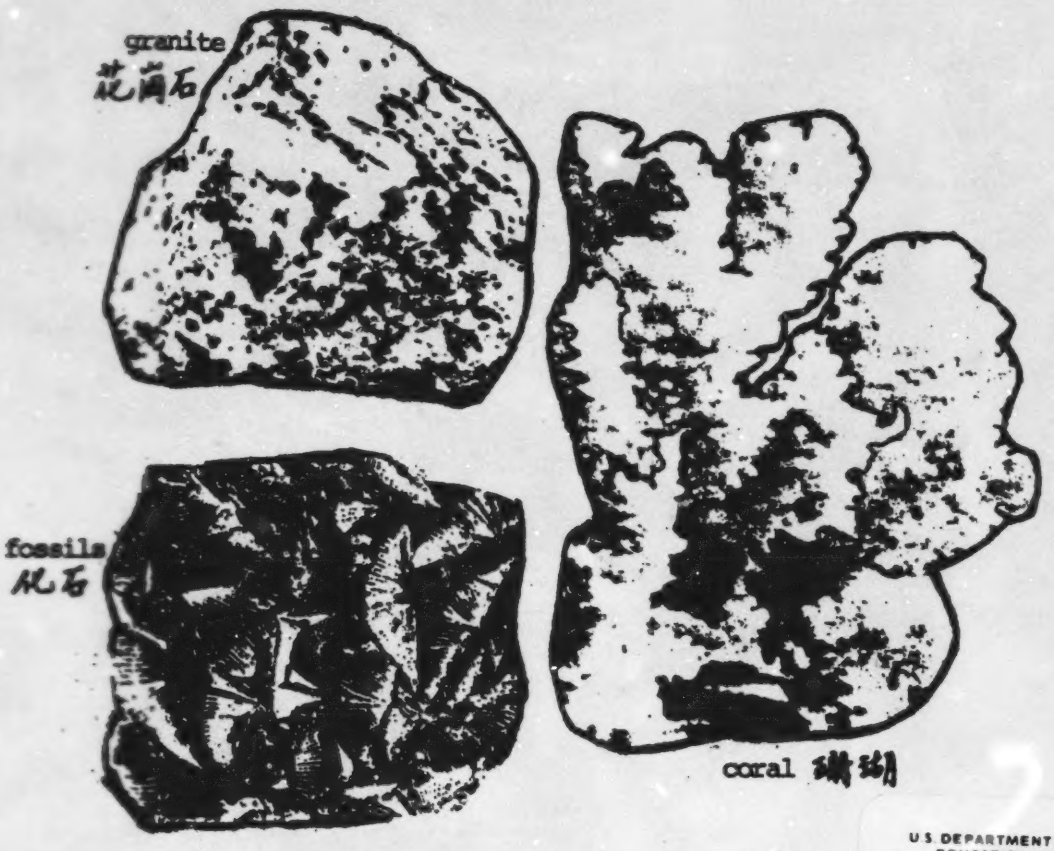
ROCKS 岩石



By Alice Lee 李潔蓮

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Preface

This science unit is primarily for the newcomer Chinese students and for those who are continuing in the ESEA Title VII Chinese Bilingual Pilot Program at the middle school level. It is designed for limited and non-English speaking students.

The unit is on Rocks: Rock Material, Classifying Rocks, Characteristics of Types of Rocks and Cycle of the Rocks. It is written in Chinese and simple English in order to meet the needs of these Chinese students. There is also a list of main terms in both languages and activities at the end of the unit. The arrangement of the main terms is according to the order of appearance in the Chinese section. This book may be used along with Matter - An Earth Science - Unit 4, published by Harcourt Brace Jovanovich.

Many thanks to Maria Julin and Herb McCall for suggestions and review, Dr. David Law for proofreading and Beatrice Choi for the calligraphy.

Alice Lee
San Francisco, CA
1980

編後話

本書是爲三藩市中美語文教育計劃下之初中學生而編。目的是幫助在英語上有困難的新移民學生。他們以學習英語爲第二種語言。

自然課本的編寫是採取單元制。本單元是關於岩石，內容分爲以下數點：岩石的本質，岩石的分類，各類岩石的特性和岩石循環。課文內容，除中國語文外，並用簡易英文寫出，以適應初學英語學生之需要。課本附有生字中英對照及習作，以爲參考之用。生字編排的次序是依據牠們在中文單元出現的先後次序而定。此單元可與自然課本 Matter - An Earth Science - Unit 4, 相配合運用。

本書在編寫過程中，得蒙富蘭克林中學自然科教師繆雯群女士及加里奧中學自然科教師 Herb McCall 賜寶貴意見及覆閱，羅國銓博士幫助校對，蔡春好女士書寫，本人在此謹表謝意。

李 潔 蓮

一九八零年於三藩市

Picture Credits

1. Brandwein, Paul F. et al. Concepts in Science (5). Sacramento: State Department of Education, 1967. Cover, pp. 4, 7, 8.

2. Brandwein, Paul F. et al. Matter - An Earth Science (5) New York: Harcourt Brace Jovanovich, 1975. Cover, pp. 3, 4, 5, 6.

岩石

岩石的本質

本集長會晶英和分據
的物有常的石色的根
的物有常的石色的根
它礦質們物有顏樣是
質。種物我礦只的這就類：
多礦。物。同成質，類
物或的石物不組本類分
的種石解合多的石分然
殼一岩方混許石岩石自
地由成和的到岩據岩。
成是組母物找些根把類
構，些雲礦中有質源。
是質那，是石，物常來分起以
石體。英石岩過礦常度述的可
岩固成石岩塊不種們程描身們
是而，一．一我的做本我成
質合石在體這

岩石的分類

堅類岩
1. 火
硬叫石

各類岩石的特性

火成岩

為，分岩可入岩或侵成或。火岩成出是。可成深噴岩的，質一，這，是樣山岩礦種閃角的種岩侵形時產中裂上很岩過做火三和有石一山或漿的便其破殼得武經它在有英物岩：火岩岩內，是山外卻玄他叫能。石礦據種是成做殼卻就火的冷，其們們種如的根兩種深叫地冷岩當球，石和我我七倒色以另下一液在的糲地岩岩岩，有，顏溶漿慢斑在熔的武岩概的深的岩慢，的熱體，石內液硬岩的變的地熱會糙。出做細玄成大淡種母擠叫幼，火。物淺四雲被石地種的岩礦是他，石岩質一成出的色其石岩態成的造噴到顏。糀態液結中程或找的石，些液凝其過岩中物長石，構是或入成候出的時。快就一火成種兩角

多不差，中合混的同不，成火的理紋細微粗。

花崗石 granite

是都岩成火的理紋細微粗。

種石等過澤好造成。

石長母經光的、石色築屋建建，由岩色岩同紋冷，是如在山是紋紅山有流面。石鄰流或火石。地的色的崗質在成，

在幼物是岩、雲石色築屋國內花是質。樣岩卻一地它的是凝

斑玢英和崗顏建建美國內華達山脈和玉樹美山谷

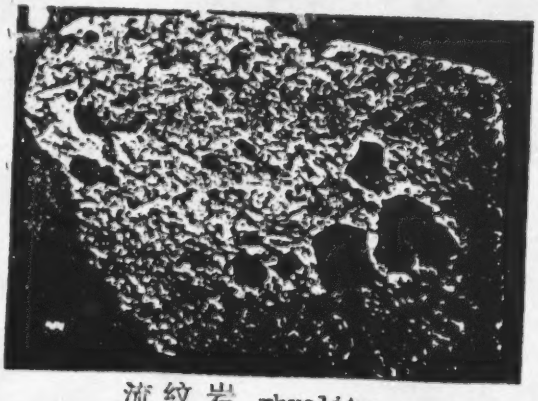
石糙種崗深石石花，

欖粗七花的由閃。後，

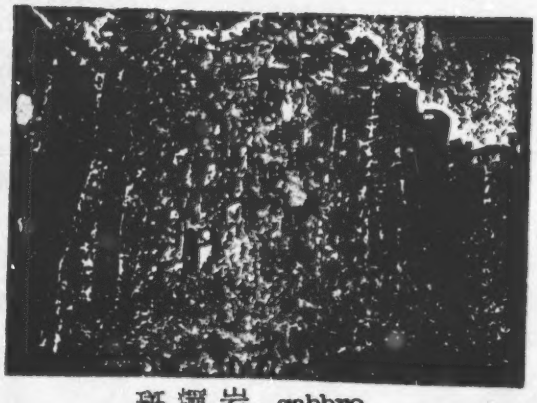
橄有這糙是角成磨麗料等的，

和所由粗它、組研美材橋州等，

褐細花物岩而



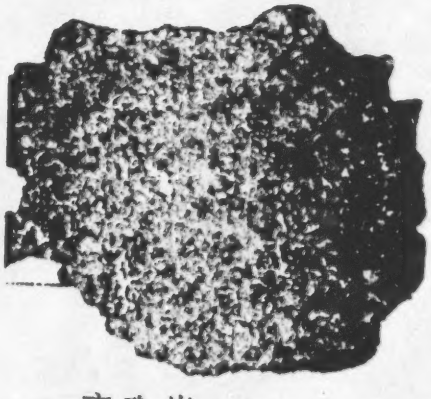
流紋岩 rhyolite



斑糲岩 gabbro

種它及哈得這一。石在塞得利看到是石糲。帕以可岩岩、成的斑糲成石構深長石河便粗糙由欖是橄得遜壁絕種岩石。

玄武岩是一種火山岩和是火質樣。但是黑色的的物一，有些西北部中的玄武理礦的一，是最好的例子。紋的岩不，有些美國比亞高原岩石，便細它糲色色，在倫精。斑顏灰。

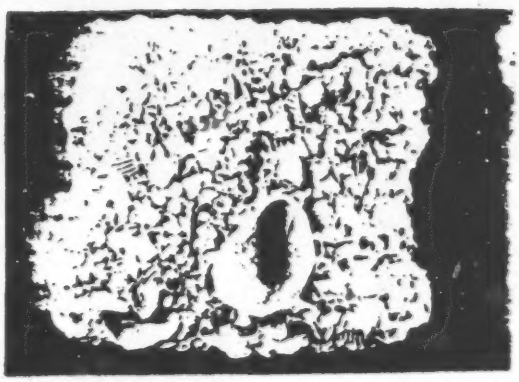


玄武岩 basalt

水成岩

水成岩是由別的細小沙粒岩石和其他物質的碎屑沉澱堆積而成。這些沉澱物是由風、雨及冰雪帶來的。

力化碎和沙岩存
重硬是石在孔的不的.
的的都岩多，多水它層由小
水漸化等粒多種或薄是
被漸，岩他最一油成成它
起着做礫其份是石而裂。
一壓叫和由成它層硬分石成。
在緊程岩是的以深凝易岩而
結物過頁們而石，地壓容鬆積
黏澱這、牠化含間是受很粗堆
物沉。岩。岩岩空常是。是的水機上骸如便物
澱的石質岩片質有岩岩岩小機有陸遺倒石動
沉層岩沙成碎沙間種。頁孔礫或有是由的。殼出
上為水石之這地多石質是物成介示
和成屑岩礫。放是圓本能動而的顯



介殼石 coquina

地經沼
種。
在，煤。
沒響成
的埋影
岩被的變
成們力便種。
水牠熱，一
機，和間的
有後力時岩形們留植是，
於謝壓長成學牠遺動，仂。
屬枯到的水化。物。份部等
是樹受年機是岩植跡部留殼
也古，萬有石成動印的保貝
煤年面千是化水代的硬的及
千下幾也
當層過鐵
成是下物最如

化石 fossils

岩
質
變

它，候化由
力時變是
類壓有的它
一和樣，成
的力成這
岩熱而成形
狀度變做岩
層高轉以熔的
於過質可由成
屬經本也是而
是石的物不變
岩岩石學並轉
質種岩化岩石
變別有和質岩
由原水變體
是把，固

岩岩一分的做・石是裂的光用　沙而裂的
質頁是以它以路夾不分石很物　由質破硬
變由它可・可舖由它會雲得築。是變易堅
是是・，層，來是・不・磨建飾岩岩容很
石，成石層廣用石成，層以多裝英礫不種
板種而狀一很或雲而石層可許做石或它一・
一質葉為途蓋　質狀一面，來　岩・是石
的變種裂用瓦　變葉成表亮它　質成，岩

板石 slate

雲石 marble

岩層片・英　種可岩沙・
質一母母石　一它的或成
變有雲雲有　是・同石而
是它・片含　岩石不崗質
岩・面片岩　麻岩多花變
片種表有片・　片的很如等
一的含英體　糙由，石
的層岩石晶　粗能石質

片岩 schists

石英片岩 quartz schist

片麻岩 gneiss

岩石循環

類三　在風成和又成岩變。岩漿岩便力後火成化熱化是。岩變。火岩的溶又程。質轉漿。物度岩便過變互岩岩澱高質後環和相為成沉過變結循岩的變火，經。凝整成慢後為物岩岩漿完水慢化成澱成質岩的、、溶便沉水變，石岩的岩卻為。為漿岩成停質冷成岩轉岩是火不變內就成便為這

石　殼後水力成。岩　地化為壓再岩

ROCKS

Rock Material

Rock is a solid material that is made up of one or more substances called minerals. Some of the minerals that make up rock are feldspar, quartz, mica and calcite. Sometimes a rock is made up of a single mineral, such as quartz. But, usually, many crystals of various minerals are found together in a rock.

Classifying Rocks

There are two ways in classifying rocks. The two ways are the descriptive classification and the genetic classification. The descriptive classification is based on such physical characteristics as color and hardness. The genetic classification is to classify rocks according to their origin.

There are three main classes of natural rocks:

1. Igneous Rocks - fire-formed
2. Sedimentary Rocks - hardened remains of sediments
3. Metamorphic Rocks - changed form

CHARACTERISTICS OF TYPES OF ROCKS

Igneous Rocks

Igneous rocks can be identified into two large classes based on texture. They are plutonic or intrusive rocks and volcanic or extrusive rocks.

Plutonic or intrusive rocks are coarse-grained igneous rocks that cool slowly and solidify underground. They are formed from hot molten material below the surface called magma. Gabbro is an example of this kind of igneous rock.

Some of the molten mixture may find its way to the surface and pour out of the earth's crust. This molten mixture called lava cools quickly and produces fine-grained rocks. They are volcanic, or extrusive, igneous rocks. Basalt is one of this kind of fine-grained texture igneous rocks that cools quickly at the earth's surface.

Seven minerals are commonly found in most igneous rocks. Three of these minerals are light colored: quartz and two feldspars. The four common dark minerals are hornblede, pyroxene, mica and olivine. In various combinations, these seven minerals make up most of the coarse-grained and fine-grained igneous rocks.

Granite is a coarse-grained plutonic rock composed mostly of quartz, feldspar, hornblende and mica. It is very strong and is often used to build bridges and buildings. Stone Mountain, Georgia, at the southern end of the Appalachian Mountains is made of granite, as are the Sierra Nevada Mountains and Yosemite Valley.

Rhyolite is a fine-grained volcanic igneous rock that contains the same minerals as granite. It ranges in color from tan to red. Rhyolite is formed as lava pours slowly out over the surface of the ground.

Gabbro is a coarse-grained plutonic rock. Gabbro is composed of feldspar, pyroxene and olivine. It is the rock that forms the Palisade Cliffs along the Hudson River.

Basalt is a fine-grained volcanic igneous rock that contains the same materials as gabbro. It is the common igneous rock which formed as lava flows hardened. It is gray or black in color. The Columbia Plateau of the northwestern United States is an excellent example of basalt.

Sedimentary Rocks

Sedimentary rocks are formed from tiny sandlike pieces of other rocks called sediment. Sediment is brought together by wind, rain and ice. Sediment is cemented together and compressed by the weight of water and new sediment above it; the particles stick firmly together. This process is called lithification, which means "turning into rock."

Sandstone, shale and conglomerate are rocks that come from lithification of fragments and grains of other rocks. They are known as clastic sedimentary rocks.

Sandstone is made up mostly of particles of quartz cemented together. Because of the spaces between the particles, sandstone is a porous rock that often holds underground deposits of oil or water.

Shale is formed when deposits of clay are put under pressure. Unlike sandstone, shale is porous, and it breaks easily into thin layers.

Conglomerate is a coarse-grained rock made up of rounded pebbles or small boulders.

Some sedimentary rocks may have an organic origin. They may be formed from living things. For example, coquina is a limestone that clearly reveals its animal origin. Bog iron is another sedimentary rock of organic origin.

Coal is considered as an organic sedimentary rock. When ancient trees fell, they were sometimes covered by sediment. Over thousands of years, the pressure of this sediment and the heat caused by the pressure produced coal.

Fossils are chemically formed sedimentary rocks. They are the remains or prints of ancient plants and animals. Best preserved are hard parts of the animal or plant, such as a shell or bone.

Metamorphic Rocks

Metamorphic rocks are rocks that have been changed from other types of rocks by great heat and pressure. This heat and pressure will change the form and minerals that make up the rock. Sometimes water and chemicals help in making the change too. Metamorphic rocks are not formed from molten material. Their changes occur in the solid rock.

Slate is a metamorphic rock formed from shale. It is a type of foliated rock that breaks into layers. Slate is usually used for roofing tiles or "flagstone" walks.

Marble is limestone that has metamorphosed. It is an unfoliated rock. It does not form sheets or layers when broken. It can be made to have a very smooth and highly polished surface. Buildings are often decorated with marble because it can be cut and polished beautifully.

Quartzite results from the metamorphism of sandstone or conglomerates. It is a hard, durable rock which is not easily worn away.

Schists are metamorphic rocks which have a layered appearance. Mica schist contains flakes of mica. Quartz schist has crystals of quartz in it.

Gneiss is a coarse-grained, banded rock. It may be formed from many different rocks, such as granite or sandstone.

CYCLE OF THE ROCKS

Igneous, sedimentary and metamorphic rocks are continually, though slowly changing into one another.

Metamorphic rocks melt to make magma. Magma becomes igneous rocks which may weather to form sediment.

Sediment is lithified into sedimentary rocks which may be changed by heat and pressure to form metamorphic rocks. The melting of the metamorphic rocks again produce magma. This production then completes the full cycle of the rocks on earth.

中英對照 Vocabulary:

岩石— rocks
固體— solid
物質，本質— material
物質— substance
礦物— minerals
組成— make up
長石— feldspar
石英— quartz
雲母— mica
方解石— calcite
混合物— mixture
不同的— various
晶體— crystals
分類— classify, classification
堅硬— hardness
描述— descriptive
自然，遺傳— genetic
根據— according
起源— origin
火成岩— igneous rocks
水成岩— sedimentary rocks
變質岩— metamorphic rocks
特性— characteristics
溶液— molten material

岩漿— magma
質地粗糙的— coarse-grained
斑糲岩— gabbro
深成岩— plutonic
侵入岩— intrusive rocks
熔岩— lava
質地幼細的— fine-grained
玄武岩— basalt
火山岩— volcanic rocks
噴出岩— extrusive rocks
角閃岩— hornblende
輝石— pyroxene
橄欖石— olivine
花崗石— granite
阿帕拉契山— Appalachian Mountains
南端— southern end
石山— Stone Mountain
喬治亞州— Georgia
內華達山脈— Sierra Nevada
玉樹美山谷— Yosemite Valley
流紋岩— rhyolite
帕利塞德絕壁— Palisade Cliffs
哈德遜河— Hudson River
哥倫比亞高原— Columbia Plateau

最好的— excellent
例子— example
沉澱物— sediment
黏結— cemented
緊壓— compressed
岩化— lithification
碎屑岩— clastic rocks
沙質岩— sandstone
頁岩— shale
礫岩— conglomerate
碎片— fragments
多孔的— porous
地下深層— underground
薄— thin
一層層— layers
小圓石— pebbles
大石頭— boulders
有機的— organic
介殼石— coquina
灰石— limestone
顯出— reveal
煤— coal
壓力— pressure

熱力— heat
沼鐵— bog iron
化石— fossils
印跡— prints
保管— preserved
板石— slate
葉狀的— foliated
瓦蓋— roofing tiles
大石板（鋪路用的）flagstone
雲石— marble
石英岩— quartzite
片岩— schist
一片片— flakes
片麻岩— gneiss
循環— cycle
風化— weather

中英對照 Vocabulary:

岩石 — rocks
固體 — solid
物質，本質 — material
物質 — substance
礦物 — minerals
組成 — make up
長石 — feldspar
石英 — quartz
雲母 — mica
方解石 — calcite
混合物 — mixture
不同的 — various
晶體 — crystals
分類 — classify, classification
堅硬 — hardness
描述 — descriptive
自然，遺傳 — genetic
根據 — according
起源 — origin
火成岩 — igneous rocks
水成岩 — sedimentary rocks
變質岩 — metamorphic rocks
特性 — characteristics
溶液 — molten material

岩漿 — magma
質地粗糙的 — coarse-grained
斑欄岩 — gabbro
深成岩 — plutonic
侵入岩 — intrusive rocks
熔岩 — lava
質地幼細的 — fine-grained
玄武岩 — basalt
火山岩 — volcanic rocks
噴出岩 — extrusive rocks
角閃岩 — hornblende
輝石 — pyroxene
橄欖石 — olivine
花崗石 — granite
阿帕拉契山 — Appalachian Mountains
南端 — southern end
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喬治亞州 — Georgia
內華達山脈 — Sierra Nevada
玉樹美山谷 — Yosemite Valley
流紋岩 — rhyolite
帕利塞德絕壁 — Palisade Cliffs
哈德遜河 — Hudson River
哥倫比亞高原 — Columbia Plateau

最好的—	excellent
例子—	example
沉澱物—	sediment
黏結—	cemented
緊壓—	compresseed
岩化—	lithification
碎屑岩—	clastic rocks
沙質岩—	sandstone
頁岩—	shale
礫岩—	conglomerate
碎片—	fragments
多孔的—	porous
地下深層—	underground
薄—	thin
一層層—	layers
小圓石—	pebbles
大石頭—	boulders
有機的—	organic
介殼石—	coquina
灰石—	limestone
顯出—	reveal
煤—	coal
壓力—	pressure
熱力—	heat
沼鐵—	bog iron
化石—	fossils
印跡—	prints
保管—	preserved
板石—	slate
葉狀的—	foliated
瓦蓋—	roofing tiles
大石板（鋪路用的）	flagstone
雲石—	marble
石英岩—	quartzite
片岩—	schist
一片片—	flakes
片麻岩—	gneiss
循環—	cycle
風化—	weather

練習：

I. 問答

1. 試說出岩石和礦物質的分別。

2. 一般來說，岩石可以分爲幾大類，試把牠們的名稱說出來？

3. 深成岩和火山岩有些什麼不同？

4. 試寫出火成岩的七種礦物質。

5. 爲甚麼花崗石是粗糙岩石，流紋岩是質地幼細的岩石呢？

6. 甚麼是水成岩？

7. 板石是屬於那一類岩石？它有些甚麼用途？

8. 試述說岩石的循環過程。

II. 課外活動

到郊外，公園或海灘拾取石塊來研究，看看牠們是屬於那一類岩石。分析後把牠們記錄下來，做一個詳細的報告。

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